The Pharma Innovation Journal 2022; SP-11(2): 1803-1806

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(2): 1803-1806

www.thepharmajournal.com
Received: 07-12-2021
Accepted: 10-01-2022

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A study on perception of soil fertility and awareness on soil erosion problems among farmers

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Abstract
Advancing food security and environmental sustainability in farming systems requires an integrated soil fertility management approach that maximizes crop production while minimizing the mining of soil nutrient reserves and the degradation of the physical and chemical properties of soil that can lead to land degradation, including soil erosion. Climate change is further aggravating land degradation, soil erosion and soil fertility. Farmers are in the situation to adopt practices that offer restoration of degraded land and stop further land degradation. The present study was conducted in selected three districts of Tamil Nadu state covering 233 respondents to analyse their perceptions about soil fertility and awareness on soil erosion problems. The result shows that, more than two-thirds of the respondents (68.24%) had low to medium level perception about soil fertility. Further, overwhelming majority (80.68%) farmers had low to medium level of awareness on soil erosion problems.

Keywords: soil fertility, soil erosion problems, perception, awareness

1. Introduction
During the last seven decades; due to rapidly increasing population, rise in per capita income, change in dietary habits, mounting wastage of food and transmission losses; demand for food has gone up substantially (Amsalu, *et al.*, 2006) [2]. Sizeable amount of arable land has been lost due to housing, roads and urban infrastructure. Simultaneously, as a result of intensive agriculture, over-grazing, deforestation, water pollution and increasing use of fertilizers and pesticides, top soil has degraded considerably with increasing salinization, loss of fertility, soil erosion and desertification. Agricultural activities and practices can cause land degradation in a number of ways depending on land use, crops grown and management practices adopted. Some of the common causes of land degradation by agriculture include extensive cultivation without any conservation measures, land clearing through clear cutting and deforestation, agricultural depletion of soil nutrients through poor farming practices, overgrazing, excessive irrigation, over drafting (the process of extracting groundwater beyond the safe yield of the aquifer), urban sprawl and commercial development, and land pollution including industrial waste disposal to arable lands. Soil erosion can have a negative impact on soil fertility. Soil fertility is the ability of soil to sustain plant growth and optimize crop yield. Soil erosion removes away the top layers of the topsoil. Loss of soil fertility can be a huge problem for farmers that can't be ignored. An integrated soil fertility management aims at maximizing the efficiency of the agronomic use of nutrients and improving crop productivity. This can be achieved through adoption of practices such as application of organic fertilizers, using green manure, cover crops, crop rotation with legumes and the use of improved germplasm combined with the knowledge on how to adapt these practices to local conditions. The perception of farmers towards soil fertility management practices greatly influences the adoption of these practices. With this background, the present study was planned to assess the perception and awareness level of farmers about soil fertility and soil erosion problems in the study area.

2. Methodology
Cuddalore, Villupuram and Thiruvarur districts were selected for the study purposively as it has more cultivable area under crop cultivation than any other districts in Tamil Nadu. Two blocks have been selected from each district based on maximum area under cultivation and totally nine blocks were selected. The multistage proportionate random sampling method could be adopted to arrive the sample size for the study and hence the final sample size was 233 respondents. The samples are drawn randomly.

2.1. Perception on soil fertility

Perception on soil fertility was operationalized as the ability of the respondents to understand the effect of soil fertility on crop production.

A five-point continuum of responses namely strongly agree, agree, undecided, disagree and strongly disagree with scores 5, 4, 3, 2 and 1 respectively was used. The maximum score one could obtain was 25 and the minimum score was five. The scores obtained for all the five statements by the individual respondent were summed up to obtain the perception score for that respondent. Cumulative frequency method was used to classify the respondents as low, medium and high perception categories. The scale developed by Prasanth (2021) [6] was adopted in this study.

2.2. Awareness on soil erosion problems

Awareness on soil erosion problems was operationally defined, as the extent to which the respondents had awareness of improved soil erosion practices.

For the present study, Teacher made test was developed to measure the awareness of soil erosion by following the procedure suggested by Anastasi (1961) [3]. Based on the expertise of the scientists and extension personnel working in the area of watershed and also based on farmers responses for each statement was recorded as aware and not aware which were assigned the score of 2 and 1 respectively. Based on the awareness score, the respondents were classified into three categories using cumulative frequency method. The scale developed by Mithun (2013) [5] was adopted in this study.

2.3. Statistical tools

2.3.1. Percentage analysis

Percentage analysis was used in descriptive analysis for making simple comparisons. For calculating percentage, the frequency of the particular cell was multiplied by 100 and divided by the total number of respondents pertaining to particular cell. Percentage was corrected to two decimal places.

2.3.2. Cumulative frequency method

This method was suggested by Rao (1987) [7] to categories the respondents into groups namely low, medium and high.

Based on the score value, the number of respondents belonging to each class was determined. The square root of frequency was calculated. Then, the cumulative frequency was multiplied by 1/3 and 2/3 to boundaries were calculated using the following formula:

$$CF = k + \frac{[Li - C]}{f} n$$

where,

k : Median between lower limit of the class in which Li occurs and the upper limit of the previous class

L_i : Boundary value namely L1 and L2

C : Cumulative square root of frequency up to the class preceding the class in which Li lies

N : Interval of the class

F : Square root of frequency in the class in which the median lies

The categories were formed as detailed below:

Below L_1 value	:	Low
Between L_1 and L_2 value	:	Medium
Above L_2 value	:	High

3. Results and Discussion

3.1. Perception on soil fertility

The distribution of respondents according to their perception on soil fertility is furnished in Table 1, classification of respondents into three categories is furnished in Table 2 and pictorial representation is given in Figure 1.

Table 1 had shown that more than (57.08%) of the respondents agreed with the statement 'Fertile soil gives good yield' followed by strongly agree (41.20%) and undecided (1.72%). None of the farmers had disagreement on the above statement.

More than one-third (37.77%) of the respondents agreed with the statement 'Plants become green with less fertilizer application' followed by disagree (29.18%), strongly agree (15.88%), strongly disagree (10.73%) and undecided (6.44%).

About half (50.64%) of the respondents agreed with the statement 'Soil fertility and crop productivity can be managed to a large extent by applying organic manures along with optimum application of chemical fertilizers' followed by disagree (17.60%), strongly agree (13.30%), strongly disagree (11.16%) and undecided (7.30%).

More than two-fifths (46.78%) of the respondents agreed with the statement 'Integrated soil fertility and nutrition management system for crop production is costly and labour-intensive' followed by strongly agree (18.45%), disagree (16.31%), undecided (10.30%) and strongly disagree (8.15%).

All the above-mentioned statements were positive. It is clear from the above statements that the majority of the respondents agreed with the positive statements related to perception on soil fertility.

About two-fifths (39.91%) of the respondents disagreed with the statement 'Good yield even if no/less fertilizer is applied' followed by agree (31.76%), undecided (9.87%), strongly agree (9.44%) and strongly disagree (9.01%).

Table 1: Distribution of the respondents according to their perception on soil fertility

(n=233)

S. No.	Statements	SA		A		UD		DA		SDA	
		No.	%	No.	%	No.	%	No.	%	No.	%
1)	Fertile soil gives good yield.	96	41.20	133	57.08	4	1.72	0	0.00	0	0.00
2)	Plants become green with less fertilizer application.	37	15.88	88	37.77	15	6.44	68	29.18	25	10.73
3)	Good yield even if no/less fertilizer is applied.	22	9.44	74	31.76	23	9.87	93	39.91	21	9.01
4)	Soil fertility and crop productivity can be managed to a large extent by applying organic manures along with optimum application of chemical fertilizers.	31	13.30	118	50.64	17	7.30	41	17.60	26	11.16
5)	Integrated soil fertility and nutrition management system for crop production is costly and labour-intensive.	43	18.45	109	46.78	24	10.30	38	16.31	19	8.15

*Multiple responses obtained

The above-mentioned statements were positive and the respondents had shown disagreement with the positive statements related to perception on soil fertility which showed that farmers were highly relied on inorganic fertilizers for achieving higher yields.

Table 2: Classification of the respondents into three categories

S. No.	Particulars	Number	Per cent age
1.	Low	81	34.76
2.	Medium	78	33.48
3.	High	74	31.76
	Total	233	100.00

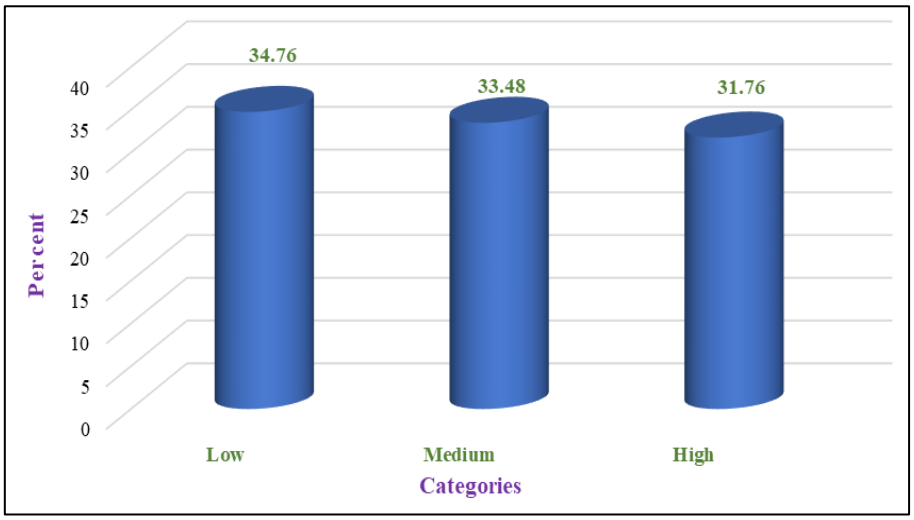

Fig 1: Classification of the respondents into three categories

It is evident from the Table 2 that, slightly more than one-third of the respondents (34.76%) had low level followed by 33.48 per cent of the respondents were found to possess medium level perception about soil fertility. Similarly, slightly less than one-third of the respondents (31.76%) were found to possess high level perception about soil fertility.

For the last two decades, the farmers were motivated to adopt new technologies mainly to increase the yield. This was greatly achieved by the application of inorganic fertilizers like urea, potassium and phosphorous. As the farmers were getting good yield in return with the application of inorganic fertilizers, they failed to notice the underlying effect on soil fertility. As continuous application of inorganic fertilizers had resulted infertility of the soil. The farmers had realized that applying inorganic fertilizers might give maximum yield, but soil fertility cannot be enhanced. It was observed that farmers were willing to adopt sustainable practices to enhance soil fertility but shortage of labour for agriculture and social pressure from fellow farmers and family made them to continue with conventional practices.

3.2. Awareness on soil erosion problems

The distribution of respondents according to their awareness on soil erosion problems is furnished in Table 3, classification of respondents into three categories is furnished in Table 4 and pictorial representation is given in Figure 2.

Table 3: Distribution of the respondents according to their awareness on soil erosion problems

*(n=233)

S. No.	Description	Aware		Not aware	
		No.	%	No.	%
1.	Reduce land value	129	55.36	104	44.64
2.	Loss of fertile soil	173	74.25	60	25.75
3.	Topography destruction	134	57.51	99	42.49
4.	Loss of soil nutrients	158	67.81	75	32.19
5.	Reduce infiltration	117	50.21	116	49.79
6.	Hindrance for tillage operation	109	46.78	124	53.22
7.	Siltation of reservoirs	103	44.21	130	55.79
8.	Soil deposition in lakes	126	54.08	107	45.92
9.	Formation of soil cakes	111	47.64	122	52.36
10.	Reduce the depth of drainage channel	69	29.61	164	70.39
11.	Flooding of down streams	84	36.05	149	63.95

*Multiple responses obtained

Table 4: Distribution of the respondents according to their awareness on soil erosion problems

S. No.	Particulars	Number	Per cent age
1.	Low	81	34.76
2.	Medium	107	45.92
3.	High	45	19.31
	Total	233	100.00

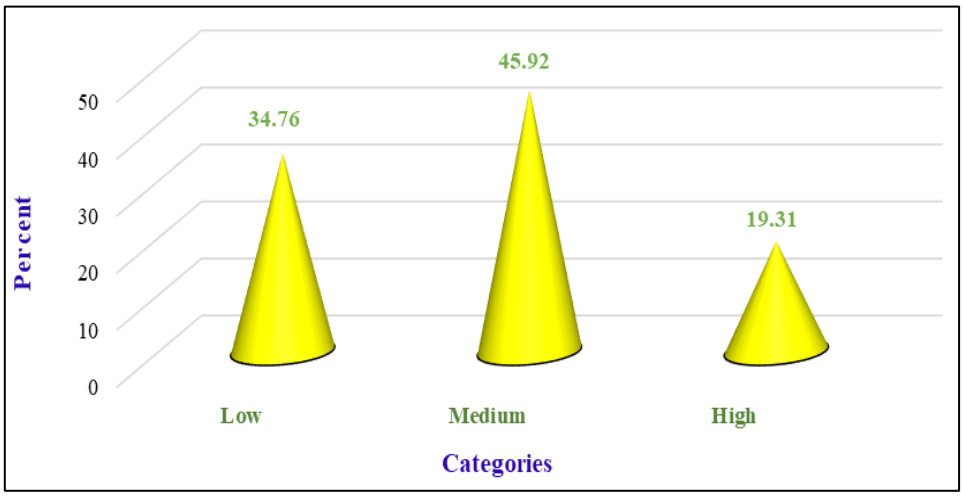

Fig 2: Distribution of the respondents according to their awareness on soil erosion problems

It is observed from Table 3 that more than two-third (74.25%) of the respondents had aware that soil erosion will leads to 'loss of fertile soil' followed by 'loss of soil nutrients' (67.81%), 'topography destruction' (57.51%), 'reduce land value' (55.36%), 'soil deposition in lakes' (54.08%) and 'reduce infiltration' (50.21%).

Correspondingly, it is observed that more than two-third (70.39%) of the respondents had unaware that soil erosion will leads to 'reduce the depth of drainage channel' followed by 'flooding of down streams (63.95%), 'siltation of reservoirs (55.79%), 'hindrance for tillage operation (53.22%) and 'formation of soil cakes (52.36%).

Table 4 stated that, more than two-fifths of the respondents (45.92%) had medium level of awareness on soil erosion problems followed by 34.76 per cent of the respondents were found to possess low level. Nearly one-fifth (19.31%) of the respondents were found to possess high level of awareness on soil erosion problems.

The results showed that overwhelming majority (80.68%) farmers had low to medium level of awareness on soil erosion problems. During the survey, farmers indicated that integrated soil management practices like mulching, crop diversification, multiple cropping are methods to adopt to reduce soil erosion. Many of them indicated that their fathers and forefathers, had adopted many such good practices to maintain a healthy soil life but in recent times they were supposed to adopt practices which will deteriorate the soil health. At the same time farmer preferences to adopt practices that gives more yield rather maintaining the soil more fertile.

4. Conclusion

Farmers decisions pertaining to soil conservation practices are largely determined by their knowledge of the problem and the perceived benefits from those practices. The results of this study show that over 70% of the farmers were failed to recognise the importance of soil fertility for maintaining the sustainability of the land. As farmers were unaware of erosion problems, their understanding of its severity arises only after visible evidences. Farmers have to use a range of techniques to maintain the fertility of the soil as well as for erosion control. Further, farmers have been changing and adapting techniques to fit local requirements. Apart from erosion control, farmers are advised to use a mix of fertility enhancing practices such as crop rotation and the application of animal manure. Overall, farmers should come forward to accept and use technologies that enhance productivity and offer long-term solutions rather than technologies offering short-term benefits.

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